Space Weather Technical Forecast

Issued on Saturday, 24 August 2024 at 01:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Moderate to High activity with further M-class flares expected, and a slight chance of X-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: High, with eight M-class flares in the last 24 hours, including an M5.1 at 23/2012 UTC from AR3800 on the southwest disc. This has been the source of the majority of the flare activity, and consists of a collection of small spots, but includes a small delta-spot. There are nine sunspot region currently on the disc, with the other main flare source AR3801 on the west disc, a relatively small and apparently simple region, but with ongoing growth and a number of small surrounding spots. The largest region is AR3790 in the southwest, and while inactive, this has seen growth within its intermediate spots, also developing a weak delta-spot. Other regions of note include AR3796 which complexified due to the development of some mixed polarity spots on its southern extent, and AR3799 which is largely simpler than the other regions, but has seen a small reverse polarity spot emerge ahead of its strong negative leader spot.

Two CMEs of note were observed. One was as a result of a C5.6 flare of AR3794 and nearby filament lift-off at around 23/0100UTC. This has been re-assessed as having a chance for a glancing impact late on day 3 (26 Aug). A filament eruption also occurred just after 23/1330 UTC off the southwest disc. This has been assessed as likely missing, passing south of Earth.

Solar Wind / Geomagnetic Activity: Slow wind conditions dominated. Solar wind speed, as measured by ACE at L1, was background, between 300 and 400 km/s. Density was around or just below average. Interplanetary Magnetic Field (IMF), Bt, was Weak to Moderate, between 5-12nT. The north-south component, Bz, was variable between -10nT and +9nT, but with more extended periods of negative directed field (southward). Phi angle was predominantly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background. High energy electron flux (greater than 2MeV) observed at GOES16 was at background. The 24-hour fluence was below the Active threshold, with 1.28e6 integrated pfu observed at 24/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Further M-class flares are expected with a slight chance of isolated X-flares.

Solar Wind /Geomagnetic Activity: The CME from the filament eruption near AR3794 just after 23/0100UTC has been assessed as passing mainly ahead of Earth, but with a chance of a glancing arrival late on day 3 (26 Aug). There are no other Earth-directed CMEs. Any influence from the northern coronal holes CH60/61 on day 1 (24 Aug) is now expected to be weak, with mainly slow wind conditions dominating. Mainly Quiet geomagnetic activity is expected, with a chance of a spell of Unsettled to Active day 1 (24 Aug) from any fast wind influence and a slight chance of Active to G1 Minor storms from any CME glance on day 3 (26 Aug).

Energetic Particles / Solar Radiation: High energy proton flux is likely to remain at background levels, but with the potential to rise in response to any notable flares, especially from AR3790 in the southwest, bringing a chance exceeding the S1/Minor solar radiation storm level should any

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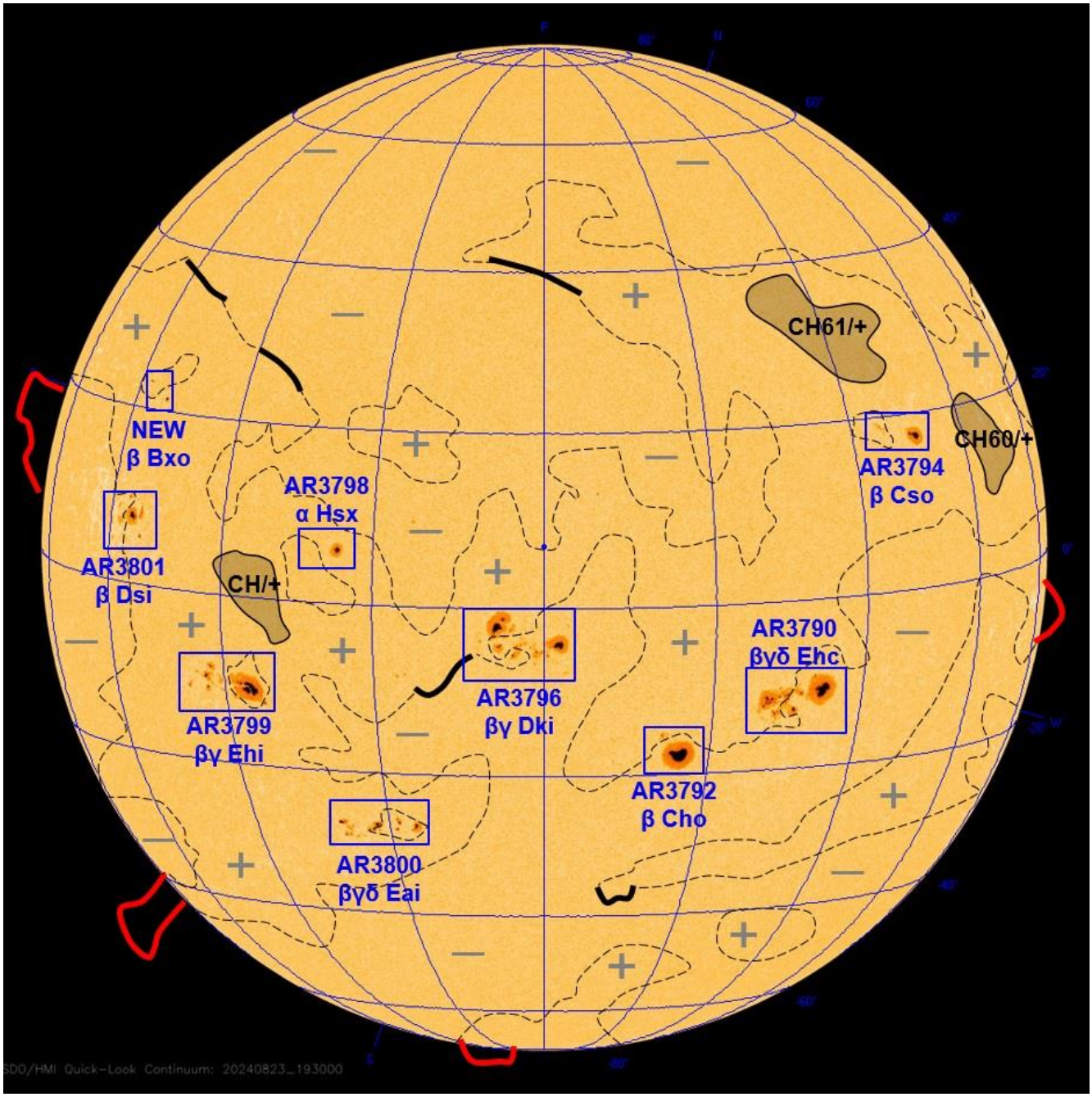
notable flares occur. High energy electron flux is expected to remain at background levels. The associated 24-hour fluence is expected to persist below the Active level.

Figure 1. Solar Analysis Valid 24/2000 UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A CME from a filament eruption near AR3794 just after 23/0100UTC, has been assessed as passing mainly ahead of Earth, but with a chance of a glancing arrival late on day 3 (26 Aug).

Otherwise mainly background slow wind conditions are expected. There is a weak coronal hole in the northwest disc, and this may bring a weak enhancement on day 1 (24 Aug), as indicated in MOSWOC Enlil, although this should have connected 24 hours earlier in the model, so confidence is very low for this to occur. No other notable enhancements are currently forecast, despite the slight enhancement indicated in MOSWOC Enlil from day 3 (26 Aug) onward.

Mainly Quiet geomagnetic activity is expected, but with a chance of Unsettled to Active spells with any coronal hole sourced enhancement day 1, and a slight chance of Active to G1 late day 3 or early day 4,(26-27 Aug), if any CME glance occurs.

Geomagnetic conditions are expected to be largely Quiet to Unsettled (Kp1-3), but with a slight chance of isolated Active to G1/Minor Storm intervals (Kp4-5) intervals on Days 1 and 2 (23-24 Aug) should we see any more significant coronal hole influence.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	20	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
23/0858	Nil	Filament + C5.6 flare	NW AR3794	416 km/s	Missing	Chance of glancing impact late 26 Aug

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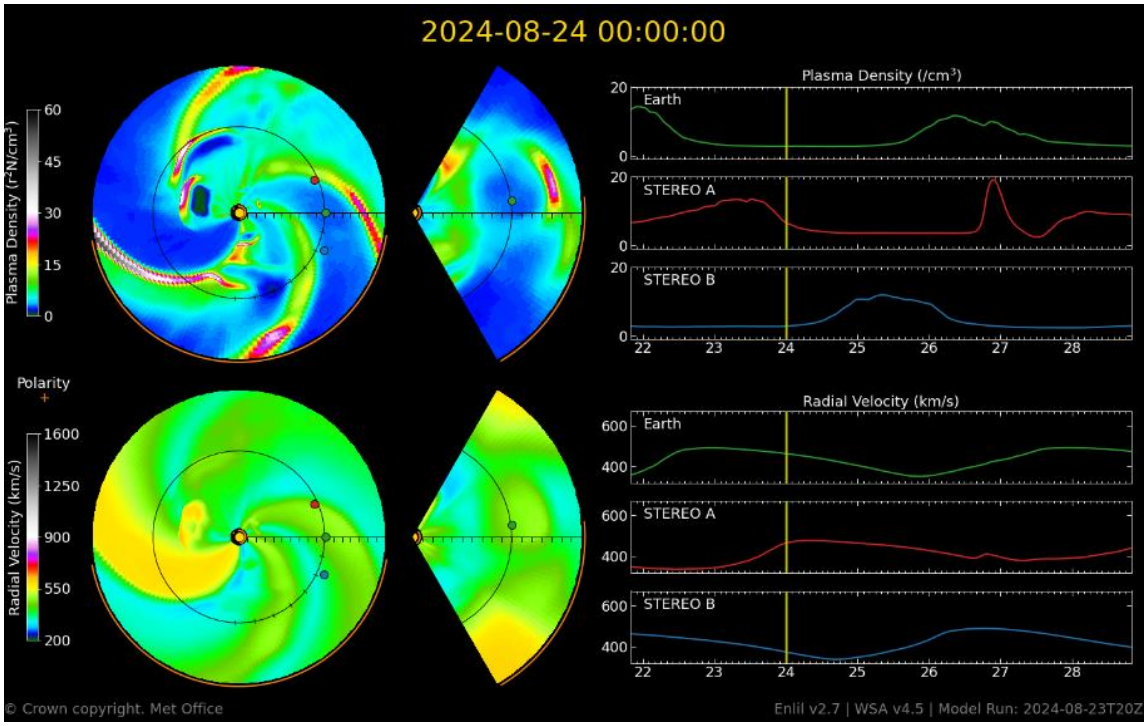
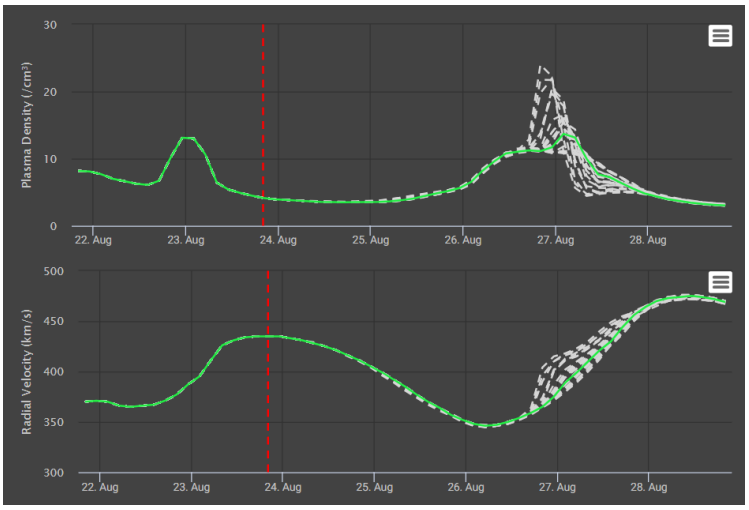
Figure 2: Enlil and ensemble





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Radio Blackouts - X-Ray Flares:

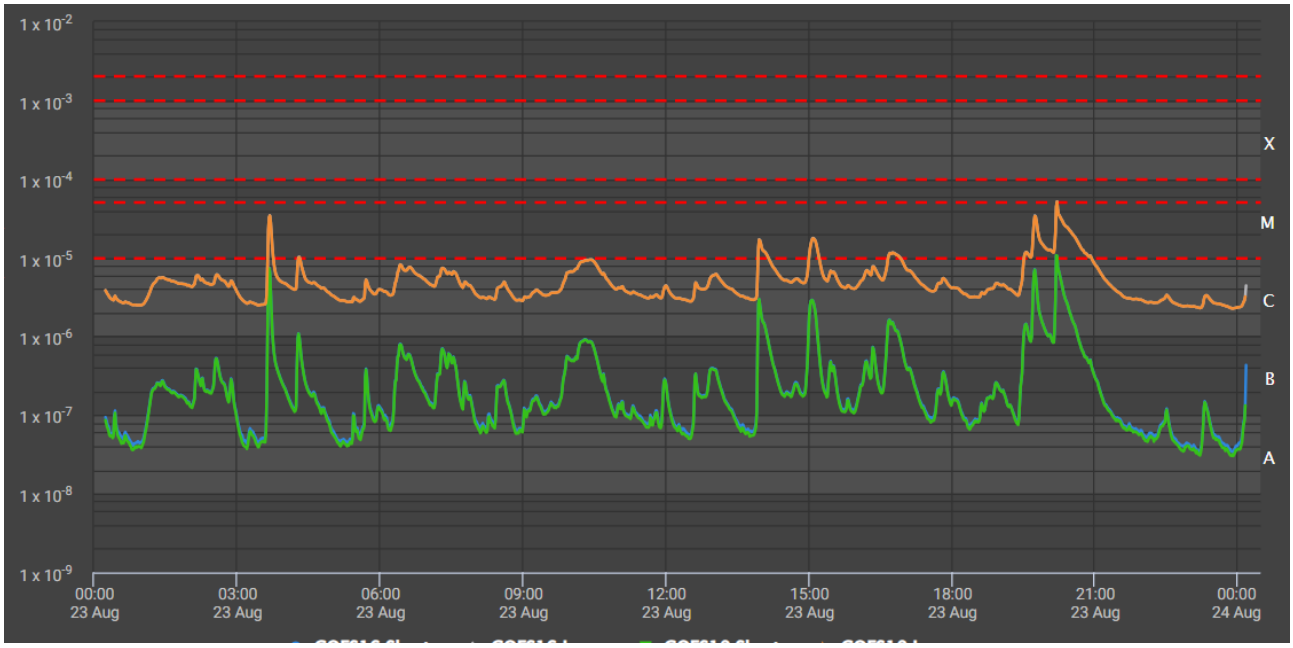
There are nine regions on the disc, with further M-flares expected and a slight chance of X-class flares.

Most notable is perhaps AR3790 in the southwest disc, as the largest region, and with a weak delta spot within its intermediate spots, however this region has remained relatively inactive. AR3800, a collection of smaller spots in the southeast disc, is currently the most active region. This also has a clear, but small delta spot within its intermediate spots.

Other regions of interest include AR3796 in the centre disc which has some complexity, due to a mixed polarity beta-gamma structure. While overall simpler AR3799 in the southwest has also seen some weak growth, with the emergence of a small reverse polarity spot ahead of its negative trailer. Growth also continues in AR3801 on the western disc, although this currently remains a simpler bipolar group.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	80	80	80	80
Very Active	R3 to R5 X Class	No	15	15	15	15

Figure 3a: GOES 16-18 X-ray flux



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as observed by GOES-18, is currently at background. AR3790 in the southwest is currently the best connected and most likely source for any proton event, however despite the development of a delta-spot configuration this region has been relatively inactive with little history of notable flares, decreasing confidence. However, there are a number of other potential flare sources on the Earth-facing disc, and subsequent proton enhancement, especially as these move into the better connected western disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	20	20	20	20
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux as observed by GOES-16 is currently at background and forecast to remain at this level. Any coronal hole soured solar wind enhancement on day one (24 Aug) is now forecast to be rather subdued, limiting the potential for any increases in the electron count at GEO.

Fluence is expected to remain below the Active (1e8 integrated pfu) threshold through the period. MOSWOC REFM is currently providing good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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